

Appl. No.: 10/563,233

Amdt. Dated October 28, 2009

Response to Office Action Mailed July 29, 2009

REMARKS:

Applicant appreciates the time and care the examiner has taken in examining the application.

On the Amendments. In the amendment above, claims 5-8, 17-20, 39-41, and 48-50 have been cancelled in order to address the drawing objection. Claim 23 has been amended to include the words "as it enters the housing of the kiln system" to be consistent with claim 1. This amendment is supported in the original specification at Para. [0048] (as originally numbered), and in original claim 37 in the national phase, and in original claim 40 and amended claim 37 in the international phase. No new matter is added.

On the Objection to the Drawings. The objection has been obviated by cancellation of all claims containing reference to the flare diffuser or the bluff body, namely claims 5-8, 17-20, 39-41, and 48-50.

On the Rejections. All contents of the prior Responses to Office Action are herein incorporated by reference.

-- *Section 112, second paragraph.* The rejection is respectfully traversed. The clause is question is submitted to be sufficiently definite under the applicable standards under Section 112, second paragraph. The clause in question is:

...wherein said injector (84,86) and said predetermined pressure are arranged and selected to inject said injection gas into the housing (92) at sufficiently high momentum to produce a jet having appropriate turbulent flow characteristics such that the process gas flow is entrained by said injected gas; and

The examiner finds the term “sufficiently” as the basis for this rejection on grounds that the word is not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention. It is noted that the CCPA has held in comparable circumstances that the term “sufficient” was found sufficiently definite when, as here, it defined particular amounts according to a functional criterion. *In re Spiller*, 182 USPQ 614, 621-22 (CCPA 1974). *In re Spiller*, the term “sufficient” was held definite under Section 112, second paragraph in the clause “...an amounts sufficient to be capable of causing selective modification of surface properties.” In overturning the determination of indefiniteness, the CCPA stated:

There is nothing indefinite in the use of claim language which defines particular amounts according to a functional criterion. . . . We note that here also there is no criticality in the amount of starch which is to ‘be electrostatically attracted to and uniformly deposited upon’ the wet web, and we agree with appellant that there is no reason why he must state in his claims ‘a feature of no importance’ to his invention, which, as previously noted, is the electrostatic deposition of dry starch on wet paper.”

Similarly, the term “sufficiently” as used in the claims herein is defined in amount according to functional criteria, namely, the momentum is sufficiently high to produce a jet having appropriate turbulent flow characteristics such that the process gas flow is entrained by said injected gas. These are definite functional criteria set forth directly in the claim. Moreover, the precise level of momentum is, as in *In re Spiller*, a feature of no particular import, other than the momentum is, as defined in the claim, sufficient to produce a jet having appropriate turbulent

flow characteristics such that the process gas flow is entrained by said injected gas. The skilled artisan would easily be able to determine the sufficient momentum. Someone skilled in the art would know from this clause that the momentum required can easily be determined when carrying out the invention and that the sufficient momentum would depend upon level of the process gas flow.

It is respectfully submitted that the examiner errs in stating that the specification does not provide a standard for ascertaining the degree, or a value or range of the momentum such that a skilled artisan could reference to determine the sufficient momentum. Paragraph [0049] (as numbered in the published version of this application, U.S. Pub. No. 2007-0184396) provides that, in a preferred case, the total momentum of the injection gas during injection is approximately 50 to 150% of the momentum of the process gas flow. A standard, range or value is also specified in dependent claim 42, which contains the limitation wherein the total momentum of said injected gas during injection is approximately 50 to 150% of a momentum of said process gas flow. A skilled artisan would be enabled, and the rejection should be reconsidered and withdrawn.

-- Section 102(e) over Hansen. Applicant respectfully traverses the rejection of claims 1-4, 9-16, 18, 21, 22, 27-39, 42-45, 47, 48, and 51-61 under Section 102(e) as anticipated by Hansen et al., U.S. Patent No. 6,672,865.

The four independent claims at issue under this rejection provide, in pertinent part:

Claim 1: "... wherein said injector (84,86) is provided with swirling means for providing axial swirl to said injected gas as it enters the housing of the kiln system..." "

Claim 23: "... said injector (84,86) is provided with swirling means for providing axial swirl to said injected gas as it enters the housing of the kiln system;..." "

Claim 37: "... further comprising imparting swirl to said injected gas as it enters a housing of the kiln system (20)."

Claim 44: "... imparting swirl to said injection gas as it enters the housing."

These claims define that the injected gas, itself, is caused to swirl about its axis of injection as it enters the housing of the kiln system. According to this wording, the axial swirl is provided to the injected gas as it enters the housing, and not to the process gas flow itself.

The structure of the swirling means (100) and the specific advantages of the swirling means (100) and the axial swirl of the injected gas as it enters the housing are described in the original specification (Paras. [0109]-[0111] (emphasis added):

[0109] As described above, the SAS 82 is provided to inject a high momentum, swirling turbulent stream of air (or other gases) into the stratified gas and particle process gas flow at an area having a temperature of approximately 850-1400 degree C in a kiln 42, gas riser 34, precalciner 58, or the like, in order to mix the process gas flow, remove the stratification and improve combustion and gas-to-particle heat transfer, making better use of available oxygen. The additional air--usually with a momentum level similar to that of the main process gas flow--arrives via injector(s) 84 or 86, designed specifically for the plant concerned.

[0110] In a preferred embodiment, the injectors 84 and 86 may also be configured to induce swirl or turbulence in the injected gases and thereby enhance entrainment of the process gas flow. FIGS. 4 and 5 show alternative arrangements of the peripheral SAS 94, in which swirl vanes 100 are included within the injectors 84 and 86. The injectors 84 and 86 may also be provided with a bluff body (not shown) or flare diffuser (not shown). A bluff body is a centrally

located solid disc or cone near the exit of the injector 84 or 86 of slightly smaller maximum diameter than the injector 84 or 86. The bluff body or flare diffuser additionally enhances jet entrainment.

[0111] There are several advantages that may be observed when using a SAS 82 with a typical process gas flow. By way of example, the Reynolds number, which indicates turbulent flow and mixing, is expected to be approximately 2.5 times higher at some 7.5×10^5 than in a typical main process gas flow, hence increasing turbulent mixing. In addition, the minimum eddy size is expected to be approximately 50 times smaller, that is, less than the size of particles of pulverized coal and raw material (around 3 microns), hence increasing heat transfer for both combustion and calcination. The turbulent frequency, which indicates the rapidity of eddy fluctuations, is also expected to be generally increased by approximately 100 times or more from perhaps $1.5 \times 10^5 \text{ sec}^{-1}$ to $5 \times 10^7 \text{ sec}^{-1}$, again facilitating mixing, combustion and heat transfer. Moreover, the jet entrainment and mixing due to the swirl vanes 100 and/or flare diffuser or bluff body is expected to be approximately 2.5 times higher in a specific distance than for injection without such elements at the same velocity, hence the amount of air and fan pressure can be lower for the same effect and give a more beneficial impact on both the installation and the process.

It is respectfully submitted that the Hansen fails to disclose the swirl means or the axial swirling feature set forth in the four independent claim clauses recited above. The examiner's Section 102(e) rejection is thus in error and should be reconsidered and withdrawn. The examiner's finding on this feature is not understandable. It appears that the examiner finds this feature in Hansen, per the examiner's discussion at page 5, lines 7 to 16. To the extent that the examiner's meaning can be discerned from the text of the rejection, it seems that the examiner

finds that Hansen discloses "swirling means for providing axial swirl to said injected gas as it enters the housing of the kiln system" in the following (Office action, p. 5, lines 7-16):

"... a combination of the position of the injectors within the kiln system and the nozzles (36) (SEE Figures 8a & 8b shows end portions with slots functioning as vanes (ie swirling means) or bluff bodies since they consist of a flattened front) aid in imparting the rotational momentum (swirling) (Figure 7 illustrates the inherent gas flow out of the nozzles as affected by the flattened fronts shown in Figures 8a & 8b as it enters the housing of the kiln system) and as can be seen in the Figures 8a & 8b have angles which anticipate the applicants claim 4 and the injectors are capable of impinging tangentially on an imaginary circle which forms towards the center of the housing as suggested by the flow shown in Figure 6 of high pressure air exiting the nozzles (36)."

It is respectfully argued that examiner's comments reveal an error in the rejection, which resides in the failure to distinguish between the overall rotational movement of the process gas flow about the longitudinal axis of the kiln (as in Hansen), and the axial swirl that is imparted by the swirling means (100) to the jets of injected air (as in the four independent claims herein).

Simply put, Hansen discloses no axial swirl in the injected gas, and discloses no means capable of imparting an axial swirl. Hansen itself states that FIGS. 8a and 8b merely illustrate "alternate nozzle orifice configurations," having "rectangular cross section," in nozzles 36 (Hansen, col. 9 lines 10-11). These are merely orifices 38 of a rectangular cross-section; they do nothing to impart axial swirl of the injected gas as it enters the housing of the kiln system. These orifices 38 are not swirling means as asserted by the examiner. There is no reference in the written description of Hansen to any axial swirling of injected gas as it enters the housing of the kiln.

As for the drawings, the flow arrows shown in FIG. 6 of Hansen coming out of the orifices 38 of nozzles 36 simply show the direction of the air coming out of the orifices 38. The flow arrows of FIG. 6 are, notably, free of any axial swirling shape; they are not of a spiral shape, which might indicate axial swirl of the injected gas. Rather, these flow arrows in FIG. 6 simply show the nozzles 36 directing high energy injected air into the rotary vessel to impart rotational momentum to the kiln gas stream. The orifices 38 direct the gas in a particular direction but nothing in the drawings, claims or written description of Hansen says or even suggests that the injected gas comes in with an axial swirl. Most importantly, these flow arrows show the direction of the air in the overall process gas flow after the injected gas has left the nozzles 36, and do not show axial swirl imparted to gas travelling through the injectors as it enters the housing.

The same is true of FIG. 7 of Hansen -- it reveals no swirling means and no axial swirl of the injected gas as it enters the housing. The pertinent discussion in Hansen follows (Hansen, col. 9, lines 24-35 (emphasis added)):

With reference to FIGS. 5 and 6, two or more air injection tubes 32 can be circumferentially (or axially) on the cylindrical wall 14 of rotary vessel 12. Pressurized air is delivered to the injection tubes by fan or blower 34 in air flow communication through manifold 46. Alternatively, as depicted in FIG. 7, each injection tube can be connected directly to a blower or fan 34 for delivery of high energy/velocity air into the kiln gas stream. The air injection tubes 34 terminate in the kiln at a point between the top of mineral bed 22 and the axis of rotation of rotary vessel 12 in the form of a nozzle for directing high energy injected air 50 into the rotary vessel to impart rotational momentum to the kiln gas stream.

The Hansen FIG. 7 flow arrows 50 simply show the direction of the air coming out of the nozzles 36. The flow arrows 50 of FIG. 7 are, notably, free of any axial swirling shape; they are

not of a spiral shape, which might indicate axial swirl of the injected gas. Rather, the flow arrows 50 simply show the direction of the high energy injected air 50 injected by the nozzles 36 into the rotary vessel to impart rotational momentum to the kiln gas stream, as explicitly stated in Hansen (see quoted portion above). The other, unnumbered flow arrows of FIG. 7 are randomly placed throughout the kiln gas stream, and seem to show no axes of swirl common with the axes of the nozzles, and so obviously cannot denote axial swirl of the injected gas as it enters the housing. Most importantly, these flow arrows show the direction of air movement in the kiln gas stream after the injected gas has left the nozzles 36, not as it enters the housing. These random unnumbered flow arrows in FIG. 7 are not explained in the text of Hansen, per se, but appear to reflect the flow described repeatedly in Hansen's text and claims as the improvement in turbulent flow and rotational momentum in the combustion gases flowing through the rotary vessel. (See, e.g., Hansen col. 2 line 66 through col. 3 line 10).

It is therefore respectfully submitted that Hansen fails to teach the following features of the independent claims:

Claim 1: "... wherein said injector (84,86) is provided with swirling means for providing axial swirl to said injected gas as it enters the housing of the kiln system..." "

Claim 23: "... said injector (84,86) is provided with swirling means for providing axial swirl to said injected gas as it enters the housing of the kiln system;..."

Claim 37: "... further comprising imparting swirl to said injected gas as it enters a housing of the kiln system (20)."

Claim 44: "... imparting swirl to said injection gas as it enters the housing."

It is submitted that no prima facie case of anticipation has been established and the rejection should be reconsidered and withdrawn.

-- Section 102(b) over Quittkat. Applicant respectfully traverses the rejection of claims 1-9, 27-30, 33-35, 37-41, 44, 45, 47-50, 57, 58, 60, and 61 under Section 102(b) as anticipated by Quittkat, U.S. Pat. No. 4,248,639.

All of the arguments above are incorporated by reference, and pertain equally to the Quittkat reference, insofar as Quittkat fails to disclose the swirling means or imparting of axial swirl to injection gas as it enters the housing. The examiner calls the blades 32, 33 of Quittkat "swirling means (32, 33) which provide an axial swirl which affect the injected gas as it enters the housing of the kiln system (SEE Figure 2); ...". However, there are no gas injectors in the device of Quittkat. The hot air simply flows through a housing and there are no separate gas injectors from which gas is injected, and in particular, injected in an axially swirling manner. Quittkat makes clear in its written description that the blades 32, 33 shown in FIG. 2 are not provided in injectors, as set forth in the device claim clauses recited above, but rather are installed in the main wall of the housing, fixed to a shaft or journaled in a bore in the wall of the conical housing 31, impart a twist to the furnace gas (Quittkat, col. 5, lines 28-32 (emphasis added)):

In the lower part of the precalcinator 27 there are provided adjustable guide blades 32 and 33 whose positions determine the quantity of furnace gas per unit time which enters the shaft 31 and, in addition, impart a twist or vortex to the furnace gas.

(Quittkat, col. 6, lines 37-45 (emphasis added)):

Each of the blades 32 and 33 is fixed to a shaft 44 or 45 journaled in a bore in the wall of the conical housing 31. At the outer end of each shaft 44, 45, a crank 46 or 47 is provided, the cranks reaching in opposite directions so that when the servomotor rotates the cranks in the same direction, the shafts are

likewise rotated in the same sense although the blades are tilted in opposite senses. This ensures the desired vortex generation in the gas.

Again, it is respectfully argued that examiner's comments reveal an error in the rejection, which resides in the failure to distinguish between the overall rotational movement of the process gas flow about the longitudinal axis of the kiln (as in Quittkat, see FIG. 2), and the axial swirl that is imparted by the swirling means (100) to the jets of injected gas (as in the four independent claims herein).

Therefore, it is submitted that no prima facie case of anticipation with respect to Quittkat has been established and the rejection should be reconsidered and withdrawn.

-- Section 103(a). Applicant respectfully traverses the rejection of claims under Section 103(a) as obvious. The arguments above remain applicable and are incorporated herein by reference. For the reasons explained above, Hansen fails to supply the features upon which the obviousness rejection relies, and therefore the Section 103(a) rejection is not supported, is not sustainable, and should be reconsidered and withdrawn.

It is thus respectfully submitted that this application is in condition for prompt allowance; and that all of the objections, rejections and requirements raised in the Office action have been met. Early, favorable treatment of this application is requested.

The examiner is encouraged to telephone the undersigned with any questions or comments so that efforts may be made to resolve any remaining issues.

Extension Request and Deposit Account Charge Authorization. The Commissioner is hereby authorized to charge any required fees, or credit any overpayment, associated with this communication, including fees for any necessary extension of time under 37 CFR §1.136(a) for

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filing this communication, which extension is hereby requested, to our Deposit Account No. 50-0305 of Chapman and Cutler LLP.

Respectfully submitted,

By: 

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CERTIFICATE OF FACSIMILE TRANSMISSION UNDER 37 C.F.R. § 1.8

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I hereby certify that the attached correspondence, namely: Response to Office Action, and deposit account charge authorization, was transmitted by facsimile on the date listed above, to the U.S. Patent Office at the facsimile number listed above, under 37 C.F.R. § 1.8.

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